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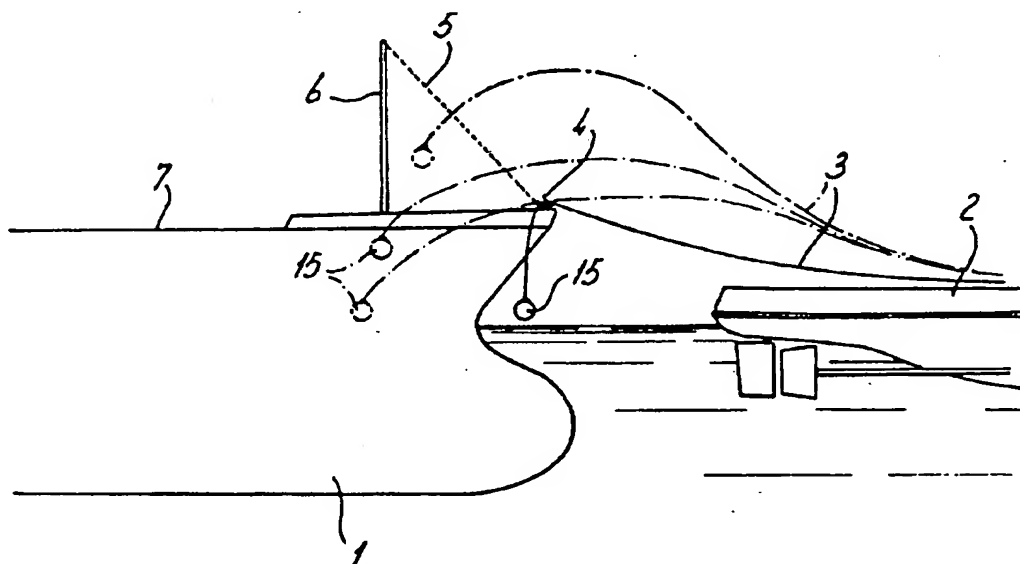


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(21) International Application Number: PCT/NL96/00376 (22) International Filing Date: 27 September 1996 (27.09.96) (30) Priority Data: 1001302 27 September 1995 (27.09.95) NL (71) Applicant (for all designated States except US): WILLEM POT B.V. [NL/NL]; Stationsplein 45, NL-3013 AK Rotterdam (NL). (72) Inventors; and (75) Inventors/Applicants (for US only): NEDERLOF, Johannes, Lourens [NL/NL]; Delftweg 128, NL-3043 NB Rotterdam (NL). HELWIG, Anthony, Peter [NL/NL]; Troelstralaan 2, NL-2805 GJ Gouda (NL). VAN DER LAAN, Markus [NL/NL]; Joh. Evertsenlaan 18, NL-2341 SV Oegstgeest (NL). (74) Agent: DE BRUIJN, Leendert, C.; Nederlandsch Octrooibureau, Scheveningsweg 82, P.O. Box 29720, NL-2502 LS The Hague (NL).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  Published With international search report. In English translation (filed in Dutch).

(54) Title: EMERGENCY TOWING DEVICE FOR VESSELS



(57) Abstract

This device consists of a catch device (4), to be mounted on a ship to be towed (1), for a towing wire (3) to be fired from the tug. A catch member (4) is detachably fitted on the end of the catch device. This catch members is connected to a line, the other end of which is connected to a chain present on the vessel to be towed. By pulling in the catch member with the associated line, a connection between the towed vessel (1) and the tug (2) can be provided by feeding round or by means of a further available line.

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## Emergency towing device for vessels

The present invention relates to an emergency towing device for vessels, comprising a chain attached to the vessel to be towed, which chain is connected to the vessel in such a way and has a length such that the free end is able to extend beyond the outer limits of the vessel. Such a chain is known in the art as a 'chafing chain'.

Following a number of recent accidents at sea involving, in particular, oil tankers, increasingly more stringent safety requirements have been imposed in recent times. These requirements relate, inter alia, to the possibility of being able to connect an unsteerable ship to a tug under difficult circumstances.

A method which is currently widely used to achieve such a connection in heavy seas is to fire a line from a tug to the deck of the vessel to be towed. On board such a vessel, this line is attached to a winch and, with the aid of the winch, a towing wire is transferred via a messenger line and attached to the ship concerned. With this method it is necessary for both a functioning winch and an operator to be present on the ship in distress.

It is inherent in an emergency situation that these conditions are not met.

Various proposals have been made in order to eliminate these problems.

A first proposal is the permanent installation of a strong towing wire on board the vessel which may have to be towed. After the tug has transferred a shooting line to the vessel, this line is connected to the towing wire and then pulled to the tug. The problems which existed as a result of the absence of a properly functioning winch are eliminated in this way.

However, it is still necessary for a person who is capable of carrying out the necessary operations to be present on the deck of the ship in distress.

A system which is simple to operate is to attach the towing wire described above to a lighter-weight line and to fire this line from the ship in distress to the tug. It is true that this operation is particularly simple, but it is not always regarded as safe by the crew of the tug. One person is still needed on the vessel in distress and the installation used for firing the messenger line has to be regularly maintained. Moreover, the power required for firing a line of this type is not always available on the ship in distress.

The aim of the present invention is to provide an improved device which

does not have the disadvantages described above. That is to say it must no longer be necessary to be dependent on the functioning of an device requiring maintenance on board the vessel to be towed or on personnel present on this vessel. Moreover, the emergency towing device according to the invention must be constructed in such a way that if the connection between the two vessels cannot immediately be successfully achieved a further attempt is easy to repeat. This does not apply when the line has to be fired from the deck of the vessel in distress and such firing is unsuccessful, because normally only one shot can be made.

10 This aim is achieved with an emergency towing device as described above in that a line member is connected to a free end of this chain, which line member is coupled at one end to the catch means mounted on the vessel, this catch means comprising a catch member detachably mounted on the vessel, which catch member is connected to the line member.

15 The invention is based on the insight that it is possible to mount catch means on the vessel to be towed; which catch means can be moved with the aid of a line brought into it from the outside. These catch means can, for example, have been mounted with the aid of a break pin on the vessel to be towed. The line which has to be placed in the catch means can come from the tug and be transferred to the vessel to be towed, for example by firing. Should a first attempt fail, further attempts with further lines are possible. There is always power on the towing vessel to make such firing possible. The catch means are fully autonomous in use, that is to say it is not necessary for operators to be present on the vessel to be towed. Furthermore, these catch means are as good as maintenance-free and can be of particularly simple construction. Consequently it is possible to increase the safety of the vessel to be towed while lowering the costs.

25 The catch means can comprise all constructions known in the prior art for catching a line fired from another vessel, such as a tug. According to an advantageous embodiment of the invention, this catch means comprise a catch line, which extends between a mast or other raised part on the vessel and a lower point of the vessel, such as the deck. With this arrangement the bottom of the catch line is preferably provided with the catch member. The various features are effectively arranged such that the catch line extends down to the prow of the vessel, where the chain to which the catch member is connected via a line member is also stored.

35 The catch member can comprise all structures known in the prior art, but preferably consists of a catch hook. Such a catch hook can, as has been

indicated above, be attached to the vessel by a break pin or by clamping means, so that this hook is quickly released from of its position when a somewhat greater force is exerted, such as that exerted by a line fired from a tug. A connection of this type can be constructed completely maintenance-free.

With the aid of this catch hook, it is possible to bring a towing wire over to the tug, which towing wire is attached to the chain. A towing wire of this type is, however, relatively long and consequently takes up appreciable space for storage. Furthermore, regular inspection of such towing wires is necessary. The investment is also relatively high because a line of this type will in practice never be used during normal operation.

In order to be less dependent on the quality of a towing wire originating from the vessel to be towed, according to an alternative embodiment of the invention it is proposed that the line member which is transferred to the towing vessel comprises a messenger line assembly with which a towing wire originating from the tug is fed round. This assembly can comprise a conventional structure, so that a double towing wire is connected to the chain of the vessel to be towed. This, however, has the disadvantage that the loop which is in contact with the final link of the chain is subjected to particularly high (frictional) forces.

In order to avoid this problem, a special towing wire originating from the tug is proposed which consists of a towing wire assembly to be fed round. This assembly, which consists of two lines, has on one side a line for feeding round, which line is attached to the point of a hook. On the other side, it has the actual towing wire which is connected to the actual hook. In this way, a hook connection between the final link of the chain and the towing wire can be provided, as a result of which the problem of wearing through is eliminated.

In order to prevent the abovementioned problem it is also possible to provide a messenger line assembly which consists of one or more messenger lines, which are made up into a loop and can be fed round, and a hook incorporated in the loop, to which hook a towing wire present on a tug can be coupled in order, by pulling in at least on messenger line from the tug, to run the hook with the towing wire connected thereto to the chain and to couple the hook to a link, preferably the final link, of the chain, the hook optionally first having been run to the tug by feeding round the messenger lines. When coupling the towing wire to the hook, the loop can advantageously be broken by breaking the connection between one of the mes-

senger line ends and the hook, optionally by cutting through or uncoupling the messenger line at the hook. In this way, a hook connection is thus provided between a link of the chain and the towing wire, by which means the problem of wearing through is eliminated and the entire operation for producing the towing connection can take place from the tug. With this arrangement, therefore, the vessel to be towed does not have to have a towing wire (because this is on the tug and is transferred from the tug to the vessel to be towed) and, furthermore, no personnel have to be present on the vessel to be towed in order to produce the towing connection.

The invention will be explained in more detail below with the aid of the illustrative embodiments shown in the drawings. In the drawings:

Fig. 1 shows, diagrammatically, in side view the production of a connection between a tug and a vessel to be towed;

Fig. 2 shows a detail of the production of the connection between the abovementioned vessels;

Fig. 3 shows a detail of the top view of the vessel to be towed;

Figs 4a and 4b show various stages of the transfer of a towing wire from the towed vessel to the tug;

Figs 5a-5e show, diagrammatically, the transfer of a towing wire from a tug to the vessel to be towed, in a first embodiment;

Figs 6a and 6b show a second embodiment of the construction according to Fig. 5;

Fig. 7 shows a top view of a forecastle with the construction according to Fig. 3 in more detail;

Fig. 8 shows a cross-sectional side view of the construction according to Fig. 7;

Fig. 9 shows the shut-off device for the passage for line and

Fig. 10 shows a further embodiment of the hook as shown in Fig. 6.

In Fig. 1 a vessel to be towed, such as a tanker, is indicated in its entirety by 1. This vessel in distress has to be towed by a tug 2. To this end, a device (not shown) is located on the after-deck of the tug for firing shooting lines 3, the free ends of which are weighted by a weight 15.

On board the vessel 1 there is a mast 6. A catch line 5 extends between the end of mast 6 and the prow of the vessel down to the deck 7. This catch line 5 can comprise any line known in the prior art and will, for example, be 10-30 mm thick. What is important is that this line has a relatively smooth surface, that is to say a low frictional resistance. Such a line can be made, for example, from a synthetic rope. The angle which the catch line

5 makes with the deck can be  $45^\circ$ , but it must be understood that a wide range of angles is possible.

At the bottom of catch line 5 there is a catch hook 4. This hook is connected via a break pin 14 to the prow of the ship, as can be seen from

Fig. 2.

Catch hook 4 is connected to a line 16. The method of connection varies depending on the embodiment of the invention.

It can be seen from Figs. 1 and 2 that if a shooting line 3 is fired to the foredeck of the vessel 1 to be towed, this line drops down along catch line 5 until it reaches catch hook 4. If force is then exerted on line 3, break pin 14, or any other fixing means provided, will no longer be effective, with the result that the hook 4 comes away from the vessel, as is shown in broken lines in Fig. 2.

Fig. 3 shows the auxiliary towing chain 10 which is always present on the foredeck of a vessel. This chain is shown in a stowage compartment. This chain is also connected to a line member, which can vary according to Figs 4 or 5 and 6, depending on the embodiment.

A first variant is shown in Figs 4a and b. In this embodiment, the catch hook 4 is connected to a single messenger line 16. The latter makes possible the relatively easy transfer of the catch hook with the aid of messenger line 3 to the tug. A heavier towing wire 17 is connected to messenger line 16, as can be seen from Fig. 4b. The other end of this towing wire 17 is connected to the chain 10 described above. After the messenger line 16 has been pulled in onto the tug, the towing wire can then be brought in. The length of chain 10 is such that this chain will always protrude through the bow of the vessel to be towed, so that chafing of the towing wire 17 against the vessel to be towed is precluded. This can clearly be seen from Fig. 4b.

Because the embodiment according to Fig. 4 requires the presence of an expensive and somewhat maintenance-sensitive towing wire on the deck of the vessel to be towed, the following variants are proposed, with which this is no longer necessary.

In Figs 5a-e a structure is shown with which a messenger line assembly consisting of lines 8 and 9 is connected to the catch hook 4. After the catch hook has been pulled on board the tug 2, feeding round is then possible by this means. On board the tug there is a towing wire 12, which is connected to line 8 and, by pulling on line 9, is moved through the final chain link of the chain on the vessel to be towed.

With this construction the presence of an unused towing wire on the vessel to be towed is no longer necessary.

In order as far as possible to restrict the wear which can occur on towing between the final link of the chain of the vessel to be towed and the towing wire, a further variant of the system according to Fig. 5 is shown in Fig. 6.

Starting from the position shown in Fig. 5d, the end of a hook 13 is then connected to the end of line 9. On the other hand, this hook 13 is attached to a towing wire 12. By means of the construction shown here, the hook 13 engages in the final chain link.

Locking means can be fitted both on hook 13 and on hook 4 so that this hooks can be non-detachably locked by these means after the relevant chain or line has been engaged.

The structure shown diagrammatically in Fig. 3 is shown in more detail in Figs 7-9.

It can be seen from Fig. 7 that chain 10 is stowed in a block of material 19 which impedes movement and can, for example, be made of polystyrene foam and is easily destroyed when a pull is exerted on chain 10. The provision of such a stowing device prevents the chain 10 from scraping over the deck.

The hook 20 shown in Fig. 7 is discussed in detail with reference to Fig. 10 and has the same function as hook 13 in Fig. 6.

In the case of the structure shown in Fig. 7, the storage for messenger line 16 is provided below the deck in compartments 21 specially fitted for this purpose. This can be seen from Fig. 8. For practical reasons, with this arrangement it is advantageous if the messenger line 16 is divided into two essentially equally long parts 16a and 16b of different colours, such as, for example, yellow and blue. With this arrangement the colour transition will preferably lie close to the connection to the catch hook 4, so that when the catch hook 4 is pulled over to the tug the crew on the tug are easily able visually to differentiate the one part 16a of the messenger line coming from the vessel to be towed from the other part 16b of the messenger line coming from the vessel to be towed. A messenger line of this type is fed through to the deck via a shut-off device 22. The latter is shown in detail in Fig. 9 and consists of a rubber bellows 24 sealingly stretched between two plates 27, 28. With the aid of a lever 25 provided with an eccentric 26 connected to plate 27, plate 28 is held pressed down in the normal operational position. When a pull is exerted on hook 4, lever



25 is pulled up and releases the pressure on plate 28 and thus on bellows 24, as a result of which the latter can be removed. Line 16 (that is to say the parts 16a and 16b) is then drawn outside the two compartments 21. It is possible to construct the shut-off device 22 as a two-part device, so that

5 when the messenger lines 16a, 16b have been completely pulled out of the compartment 21, the shut-off device 22 falls apart when the ends of the link lines 43 and 40 to hook 20 which are connected to the messenger lines 16a, 16b emerge from the shut-off device 22 via the opening for seating the bellows 24. That part of messenger line 16 located on deck can be con-

10 structed as a wire rope, so that this is not subject to any damage due to weather conditions (ultraviolet radiation), whilst that part of messenger line 16 located below deck can be produced from relatively inexpensive polypropene material. For this reason, part 16a of the messenger line is connected via wire rope 43 to hook 20 at 33 and part 16b of the messenger

15 line is connected via wire rope 40 to hook 20 at 41. The fixing of the hook 4 is not shown in detail in Fig. 8. This fixing can comprise any construction known in the prior art, such as a slider. Hook 4 is connected via a line 50 to lever 25.

A further variant of hook 13 of Fig. 6 is shown in Fig. 10. This hook is

20 indicated in its entirety by 30 and consists of a base section 31, which is to be connected to the towing hawser and to which an auxiliary arm 32 is hingeably connected, on which auxiliary arm 32, in turn, a curved part 33 is hingeably fixed, to which, in turn, a messenger line, preferably an abovementioned wire rope section 43, is attached. When a load is applied to

25 line 16, part 33 will be lifted, so that passage through chain link 34 (see Fig. 7) at the end of the operation shown in Fig. 6a can be appreciably facilitated. It will be understood that in the position shown in Fig. 6b locking of part 32 to part 31 takes place in a manner which is not shown in more detail. Hook 20 from Fig. 7 and hook 30 from Fig. 9 are essentially

30 identical.

With the emergency towing device according to Fig. 9, the towing connection can, briefly summarised, advantageously be produced as follows. A shooting line 3 is fired from the tug and the connection between the shooting line and hook 4 is produced in the manner already described. Hook 4 is

35 pulled free and drawn in the direction of the tug, during which operation lever 25 is turned so that the bellows 24 is pulled out of shut-off device 22 by heaving in the shooting line fired from the tug back onto the tug again. Heaving in is continued until the messenger lines 16a and 16b have

been pulled fully out of the compartments 21 and shut-off device 22 of the vessel to be towed has been pulled free and has split into two. Hook 20 or hook 30 (as numbered in Fig. 10) can then be brought over to the tug by feeding. When hook 20, 30 has reached the tug, wire rope 40 with its loop termination 41 can be detached from the hooks 20, 30 and the towing wire can be attached to the hook 20, 30 on board the tug. By then starting to heave in the messenger line 16a on the tug, the hook 20, 30 can be returned to the vessel to be towed until this hook 20, 30 engages in the final link of chain 10. The towing connection between the vessel to be towed and the tug has then been produced without any crew having been needed on the vessel to be towed in order to achieve this.

Although the invention has been described above with reference to a preferred embodiment, it must be understood that numerous modifications can be made thereto without going beyond the scope of the present application.

15 For instance, it is possible to effect fixing of the catch hook to the vessel using clamping systems or other systems which can be broken loose. Furthermore, the chain can be installed in any location on the ship, such as the stern, and the realisation of a connection to a vessel can also serve for the transfer of goods, persons or power.

Claims

1. Emergency towing device for vessels, comprising a chain (10) attached to the vessel (1) to be towed, which chain (10) is connected to the vessel in such a way and has a length such that the free end is able to extend beyond the outer limits of the vessel, characterised in that a line member is connected to the free end of this chain, which line member is coupled at the other end to catch means (4, 5) mounted on the vessel, which catch means comprise a catch member detachably mounted on the vessel, which catch member is connected to the line member.
2. Emergency towing device according to Claim 1, wherein this catch means comprise at least a catch line (5), extending between a mast (6) or another higher part of the vessel and the deck (7) thereof, the catch member member mounted at the bottom end.
3. Emergency towing device according to Claim 2, wherein the catch line is arranged extending upward from the chain storage device.
4. Emergency towing device according to one of the preceding claims, wherein the catch member comprises a catch hook.
5. Emergency towing device according to one of the preceding claims, wherein the catch hook is attached to the vessel by a break pin.
6. Emergency towing device according to one of the preceding claims, wherein the line member comprises a messenger line assembly.
7. Emergency towing device according to Claim 6, wherein the messenger line assembly (7) comprises two parallel mutually connected lines (8, 9) which can be fed round.
8. Emergency towing device comprising a towing wire assembly which can be coupled to the chain (10), this towing wire assembly comprising two parallel lines (9, 12) which can be pulled through the chain, wherein one line comprises a messenger line (9), which is connected to the hook end of a hook (13), which hook is connected on the other hand to the other line (12), which is constructed as a towing wire.

fig-1

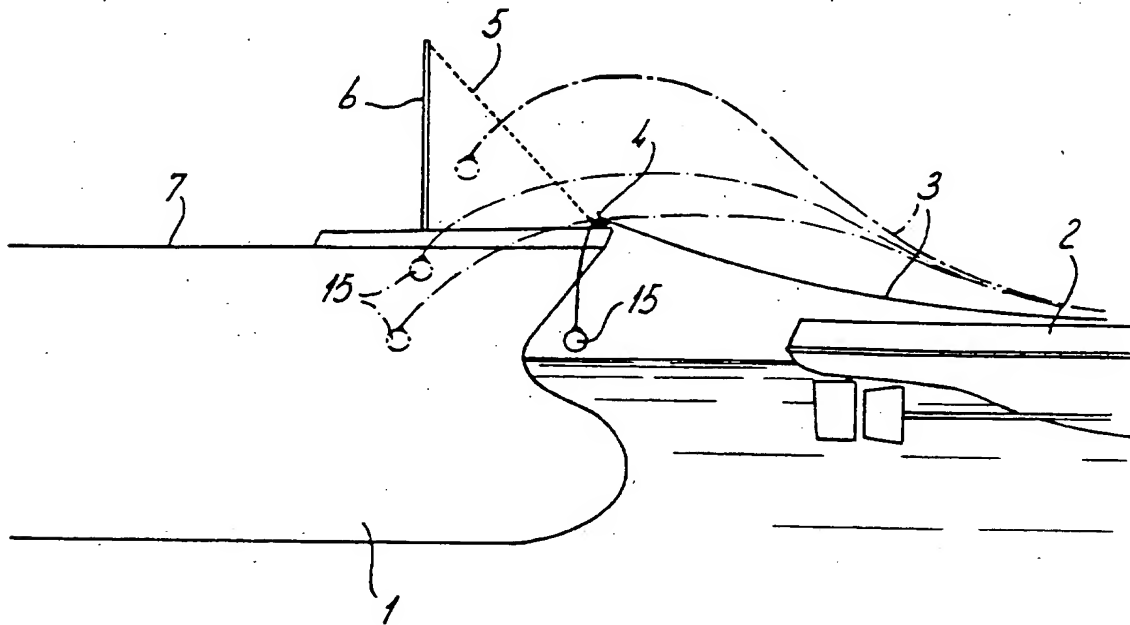
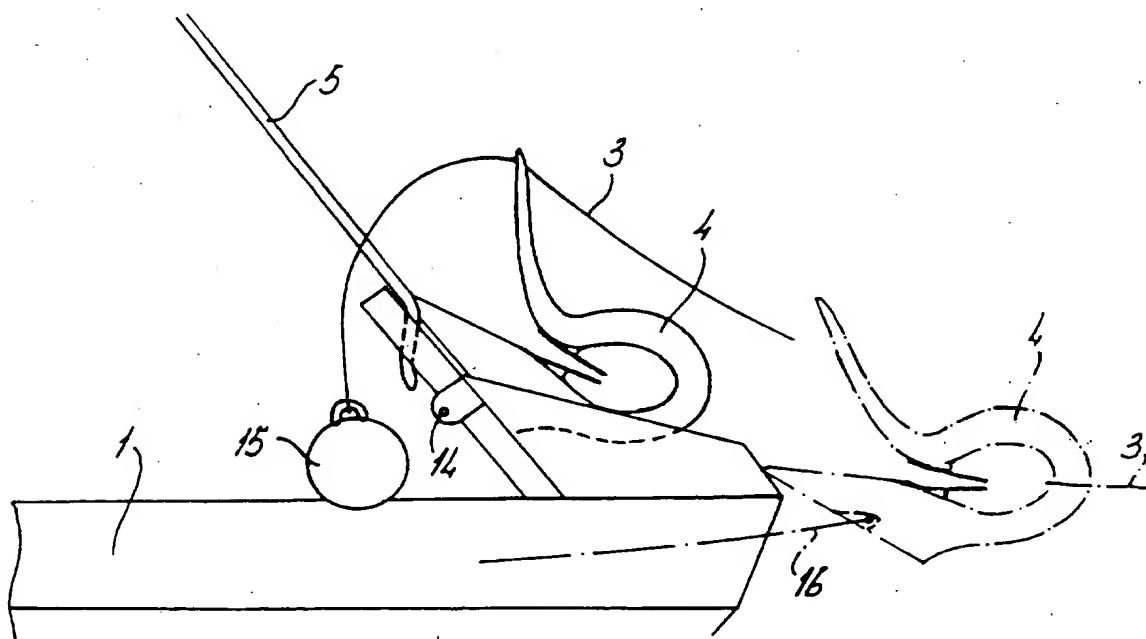


fig-2



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fig - 3

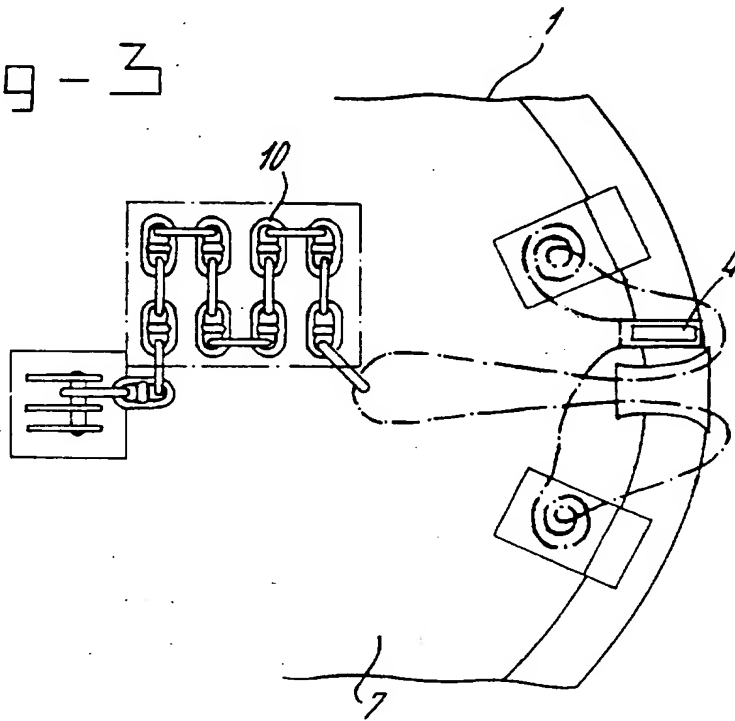


fig - 4a

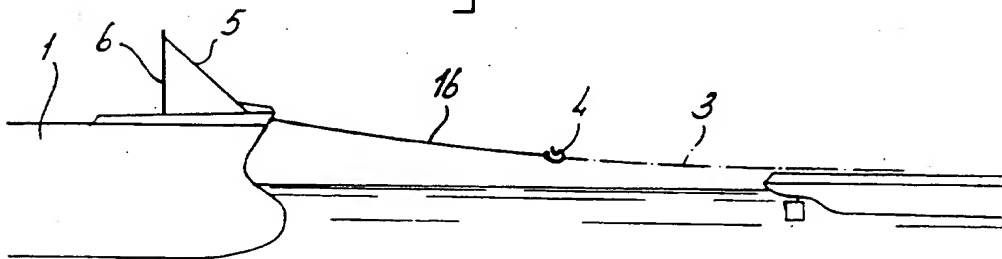


fig - 4b

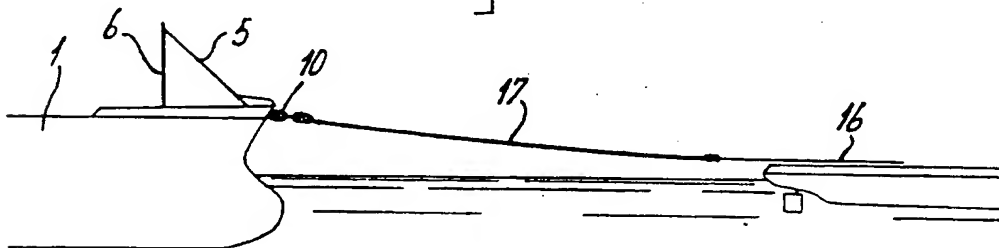


fig-5a

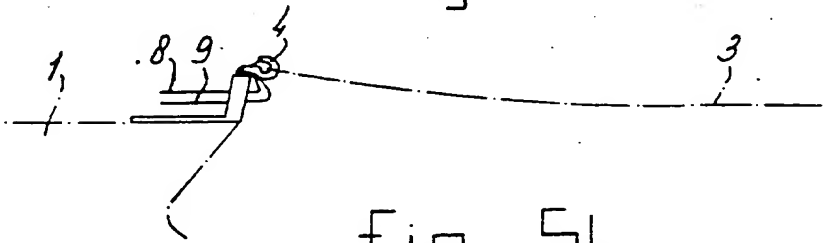


fig-5b

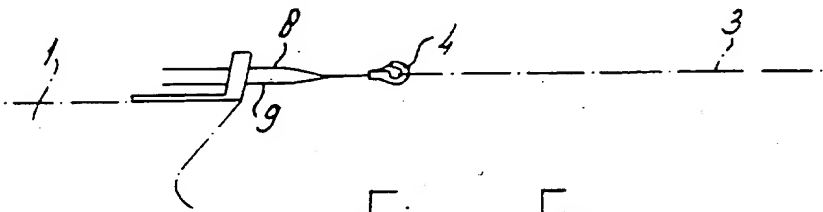


fig-5c

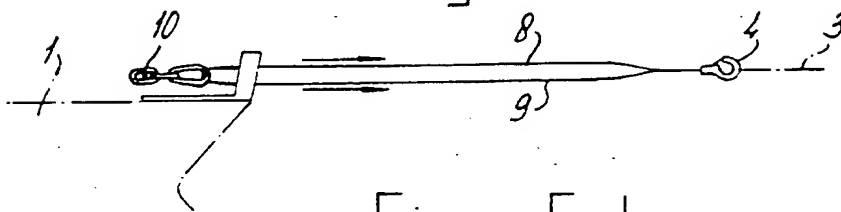


fig-5d

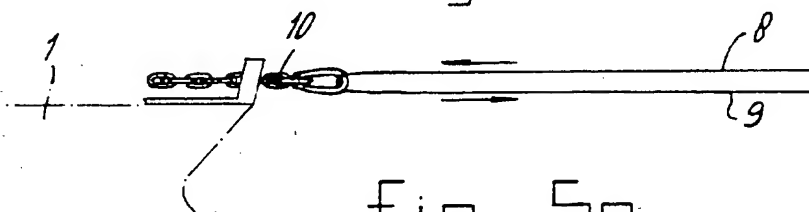


fig-5e

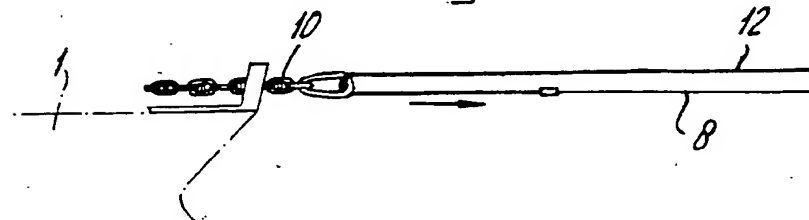


fig - 6a

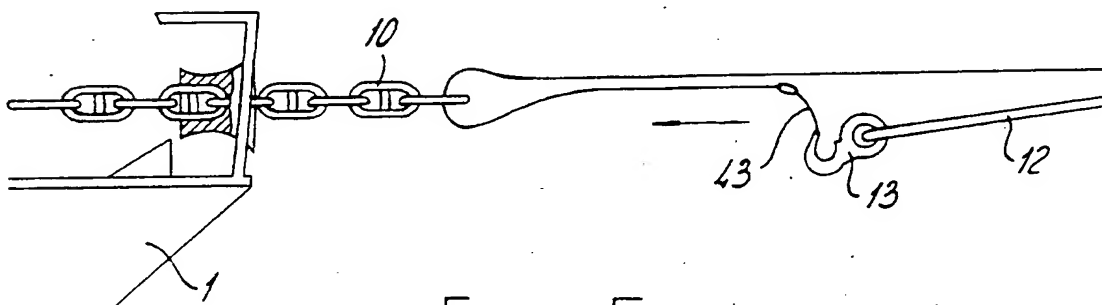
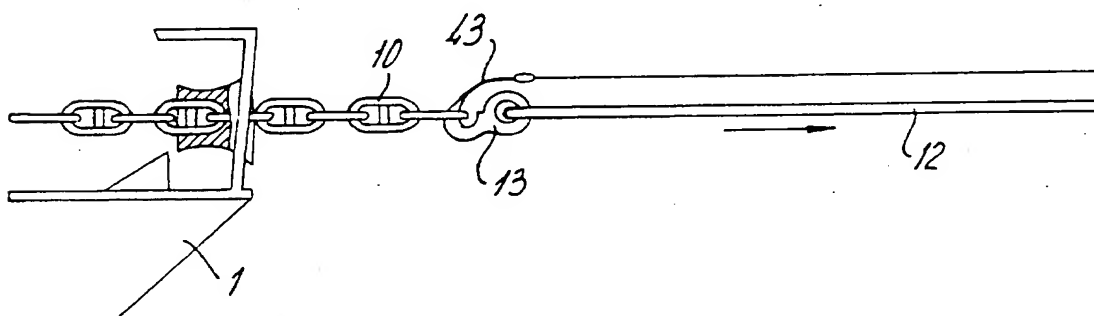


fig - 6b



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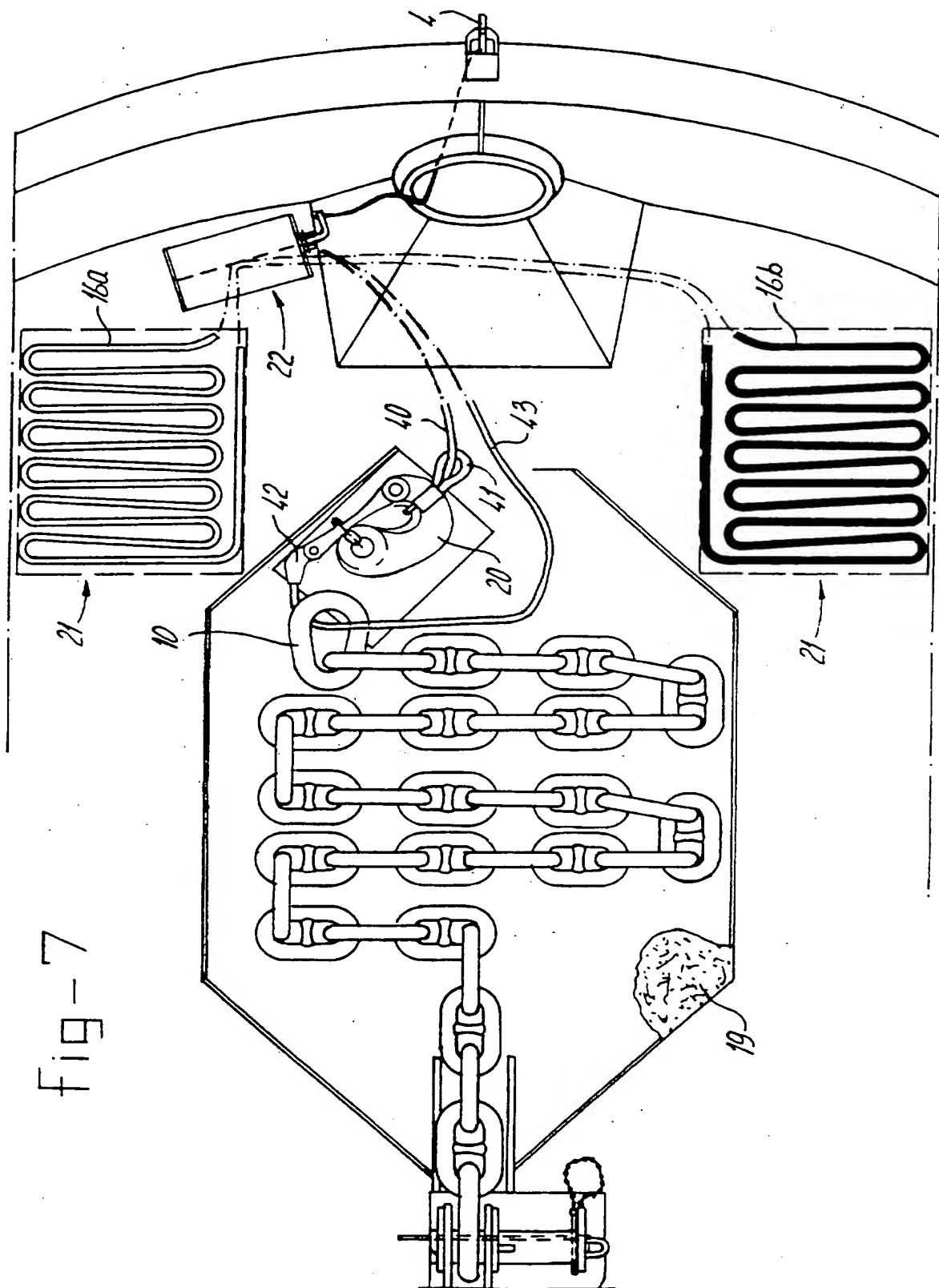


fig-7



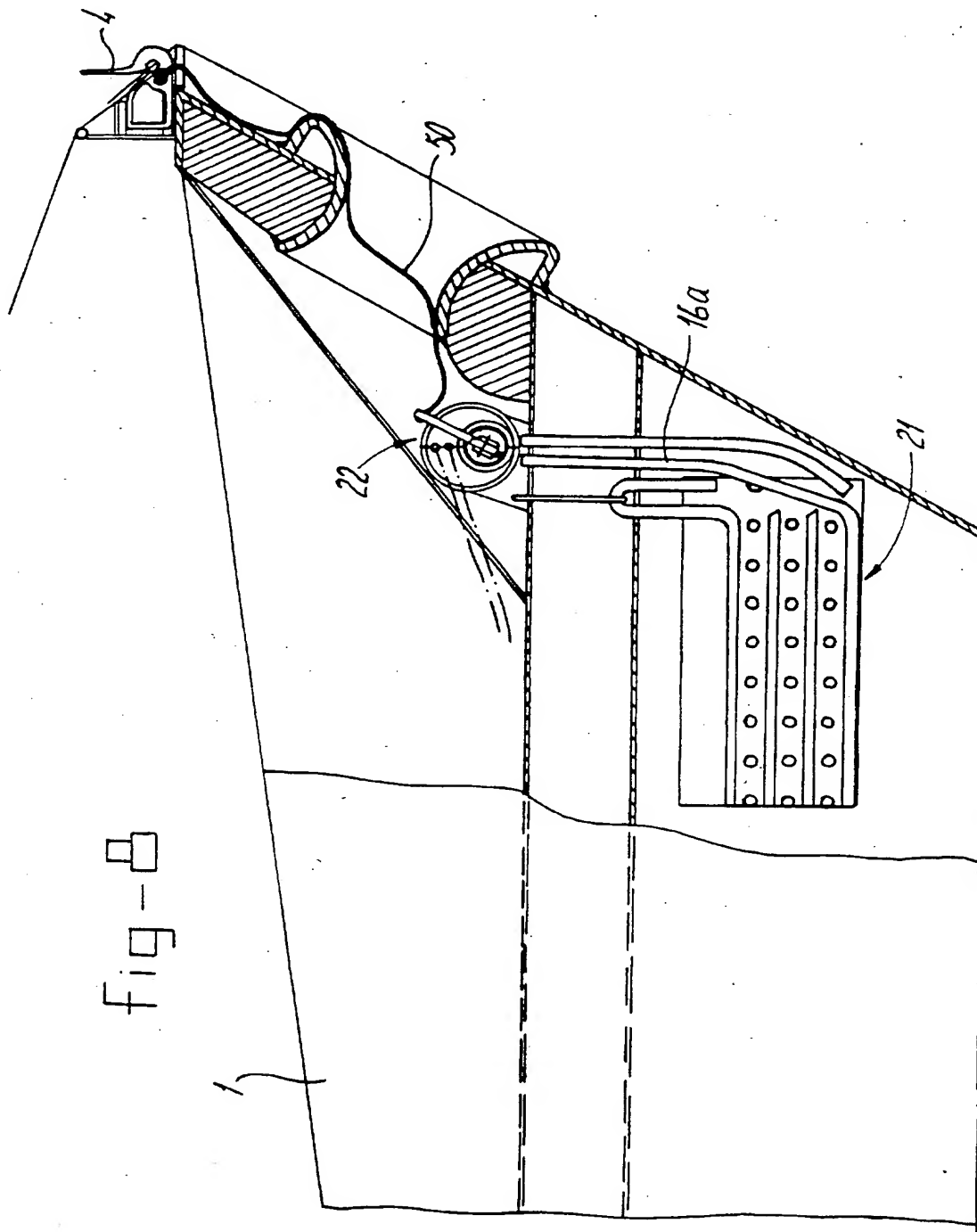


fig-9

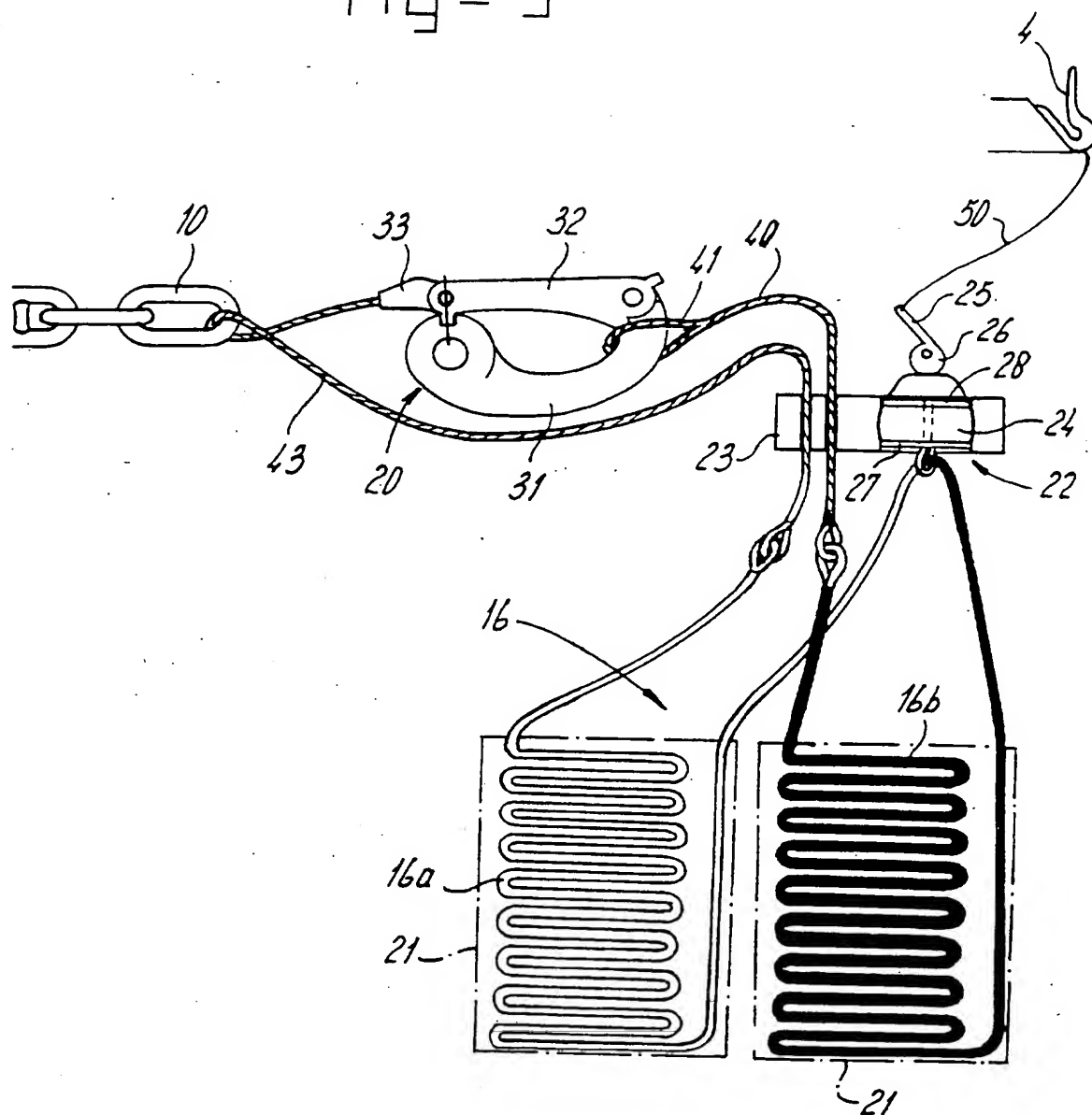
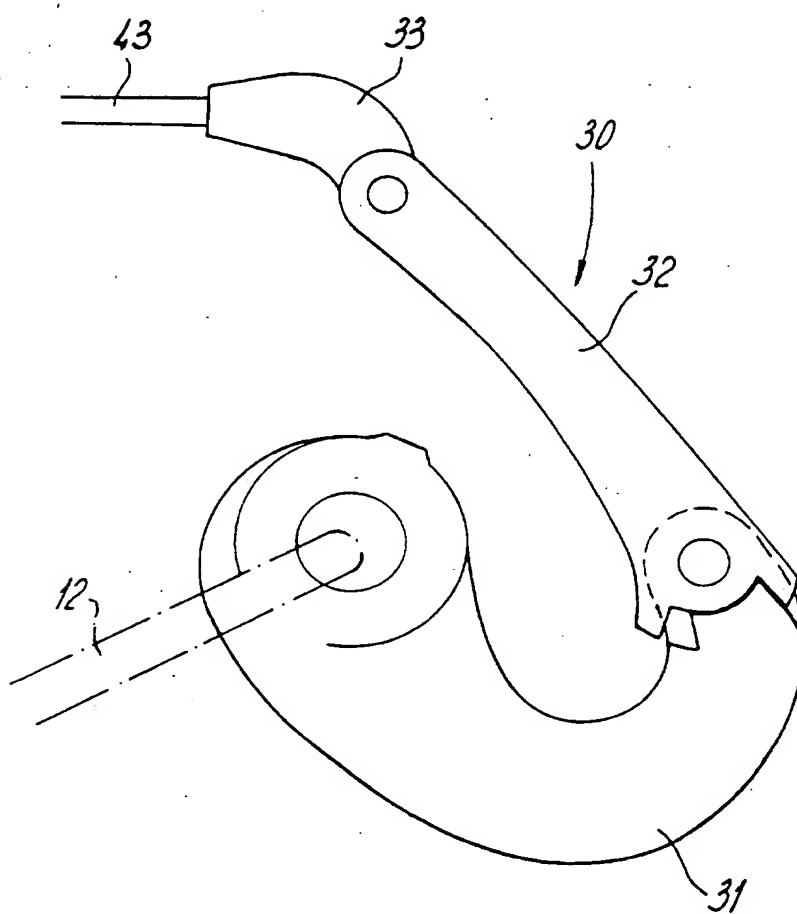


fig - 10



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/NL 96/00376

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 B63B21/56

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 B63B B63C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO,A,95 13958 (RAPP BOMEK A/S) 26 May 1995 see abstract; figures ---	1
A	NL,A,7 806 357 (W.ZANTVOORT) 14 December 1979 see claims; figures ---	1
A	DE,A,43 29 557 (R.MEYNELL) 9 March 1995 see claims; figures -----	1,6-8

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9513958	26-05-95	NO-A- 934165 FI-A- 962116	19-05-95 16-07-96
NL-A-7806357	14-12-79	NONE	
DE-A-4329557	09-03-95	NONE	

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